

REMARKS

By the present amendment and response, independent claims 1, 10, 14, 18, and 26 and dependent claims 2 and 3 have been amended to overcome the Examiner's objections and claims 33-36 have been added. New claim 33 is the independent form of claim 2, which includes all of the limitations of base claim 1. New claim 34 now depends from claim 33 and corresponds to dependent claim 3, which depends from claim 2. New claims 35 and 36 now depend from claim 33 and correspond, respectively, to dependent claims 4 and 5, which depend from claim 3. New claims 33-36 are thus allowable according to the Examiner's comments on page 5 of the Office Action date July 3, 2003. Thus, claims 1-10, 14-18, 20-24, 26, 28-31, and 33-36 are pending in the present application and claims 33-36 are now in condition for allowance. Reconsideration and allowance of outstanding claims 1-10, 14-18, 20-24, 26, and 28-31 in view of the following remarks are requested.

The Examiner has rejected claim 18 under 35 USC §112, second paragraph. Applicant has amended claim 18 in response to the Examiner's objection and submits that the requirements of 35 USC §112, second paragraph, have been met.

The Examiner has further rejected claims 10, 14, 26, and 28 under 35 USC §103(a) as being unpatentable over U.S. patent number 6,030,541 to Adkisson et al. ("Adkisson") and "Silicon Processing for the VLSI Era Volume 1: Process Technology," pp. 429-455 and 518, by Wolf et al. ("Wolf"). For the reasons discussed below, Applicant respectfully

submits that the present invention, as defined by amended independent claims 10, 14, and 26, is patentably distinguishable over Adkisson and Wolf.

The present invention, as defined by amended independent claim 10, teaches, among other things, “pattern etching the layer of silicon oxynitride and the layer of polycrystalline silicon to form a stack,” and “etching the remaining layer of silicon oxynitride in the stack in a phosphoric acid etchant without subjecting the layer of silicon oxynitride to any temperature greater than about 400°C after the step of depositing the layer of silicon oxynitride.” As disclosed in the present application, after a stack has been formed, the layer of silicon oxynitride remaining in the stack must be removed without deleteriously etching the exposed edges of the other layers in the stack, such as the exposed edge of silicon nitride in an interpoly layer. To accomplish this, the silicon oxynitride can be effectively removed at a fast etch rate of about 6nm per minute in hot phosphoric acid. However, if the silicon oxynitride has been subjected to any high temperature treatment, such as an oxidation process, the etch rate of the silicon oxynitride in the hot phosphoric acid is undesirably low, which causes serious etching of the exposed edge of the silicon nitride in the interpoly layer. Thus, by ensuring that the layer of silicon oxynitride is not subjected to a temperature greater than about 400°C after it has been depositing, the layer of silicon oxynitride in the stack can be effectively removed at sufficiently fast etch rate of about 6nm per minute utilizing the present invention. As a result, the present invention effectively removes the layer of silicon oxynitride in the stack without deleteriously etching the exposed edges of silicon nitride in the stack.

In contrast to the present invention as defined by amended independent claim 10, Adkisson does not teach, disclose, or suggest “pattern etching the layer of silicon oxynitride and the layer of polycrystalline silicon to form a stack,” and “etching the remaining layer of silicon oxynitride in the stack in a phosphoric acid etchant without subjecting the layer of silicon oxynitride to any temperature greater than about 400°C after the step of depositing the layer of silicon oxynitride.” Adkisson specifically discloses removing anti-reflective coating 16 before etching the underlying polysilicon film to avoid disrupting the poly gate structure material. See, for example, Adkisson, column 5, lines 35-54. In Adkisson, after removal of anti-reflective coating 16, hard mask 14, which underlies anti-reflective coating 16, is then used as a mask for etching the underlying surface, such as the polysilicon surface in the case of the preferred structures. See, for example, Adkisson, column 5, lines 50-53. Thus, in Adkisson, anti-reflective coating 16 is removed prior to etching the polysilicon surface.

Furthermore, Adkisson fails to teach, disclose, or suggest etching a layer of polysilicon to form a stack comprising a layer of silicon oxynitride and then removing the layer of oxynitride in the stack. In fact, Adkisson fails to teach, disclose, or suggest etching layers of silicon oxynitride and polycrystalline silicon to form a stack. Moreover, Adkisson fails to teach, disclose, or suggest etching the remaining layer of silicon oxynitride in the stack in a phosphoric acid etchant without subjecting the layer of silicon oxynitride to any temperature greater than about 400°C after the layer of silicon oxynitride has been deposited.

In contrast to the present invention as defined by amended independent claim 10, Wolf does not teach, disclose, or suggest “pattern etching the layer of silicon oxynitride and the layer of polycrystalline silicon to form a stack,” and “etching the remaining layer of silicon oxynitride in the stack in a phosphoric acid etchant without subjecting the layer of silicon oxynitride to any temperature greater than about 400°C after the step of depositing the layer of silicon oxynitride.” The Examiner has cited Wolf to show that the processing of photoresist is performed utilizing a temperature that is less than 400°C. However, Wolf in combination with Adkisson fail to teach, disclose, or suggest the elements of amended independent claim 10 as discussed above.

For the foregoing reasons, Applicant respectfully submits that the present invention, as defined by amended independent claim 10, is not suggested, disclosed, or taught by Adkisson and Wolf. As such, the present invention, as defined by amended independent claim 10, is patentably distinguishable over Adkisson and Wolf, either singly or in combination.

The present invention, as defined by amended independent claim 14, teaches, among other things, “pattern etching the first and second layers and the layer of polycrystalline silicon to form a stack,” and “etching the second layer in the stack in an etchant comprising hot phosphoric acid, the etching occurring before the second layer is subjected to any temperature greater than about 400°C.” The present invention as defined by amended independent claim 14 achieves similar advantages as the present invention as defined by amended independent claim 10 discussed above. For similar reasons as

discussed above, Adkisson and Wolf fail to teach, disclose, or suggest “pattern etching the first and second layers and the layer of polycrystalline silicon to form a stack,” and “etching the second layer in the stack in an etchant comprising hot phosphoric acid, the etching occurring before the second layer is subjected to any temperature greater than about 400°C.”

For the foregoing reasons, Applicant respectfully submits that the present invention, as defined by amended independent claim 14, is not suggested, disclosed, or taught by Adkisson and Wolf. As such, the present invention, as defined by amended independent claim 14, is patentably distinguishable over Adkisson and Wolf, either singly or in combination.

The present invention, as defined by amended independent claim 26, teaches, among other things, “pattern etching the layer of silicon oxynitride and the layer of polycrystalline silicon to form a stack,” and “removing the layer of silicon oxynitride in the stack before subjecting the layer of silicon oxynitride to a temperature greater than about 400°C after the step of depositing the layer of silicon oxynitride.” For similar reasons as discussed above, Applicant respectfully submits that the present invention, as defined by amended independent claim 26, is not suggested, disclosed, or taught by Adkisson and Wolf. As such, the present invention, as defined by amended independent claim 26, is patentably distinguishable over Adkisson and Wolf, either singly or in combination. Thus claim 28 depending from amended independent claim 26 is, *a fortiori*,

also patentably distinguishable over Adkisson and Wolf for at least the reasons presented above and also for additional limitations contained in the dependent claim.

The Examiner has further rejected claims 1, 6, 7, 18, 20, and 23 under 35 USC §103(a) as being unpatentable over Adkisson and Wolf and further in view of U.S. patent no. 5,620,913 to Hsiao-Lun Lee ("Lee"). For the reasons discussed below, Applicant respectfully submits that the present invention, as defined by amended independent claims 1 and 18, is patentably distinguishable over Adkisson, Wolf, and Lee, singly or in any combination thereof.

The present invention, as defined by amended independent claim 1, teaches, among other things, "pattern etching the anti-reflective coating, the layer of polycrystalline silicon and the silicon nitride layer to form a stack," and "removing the remaining layer of silicon oxynitride in the stack by etching in hot phosphoric acid before subjecting the layer of silicon oxynitride to any temperature greater than about 400°C." The present invention as defined by amended independent claim 1 achieves similar advantages as the present invention as defined by amended independent claim 10 discussed above. For similar reasons as discussed above, Adkisson and Wolf fail to teach, disclose, or suggest "pattern etching the anti-reflective coating, the layer of polycrystalline silicon and the silicon nitride layer to form a stack," and "removing the remaining layer of silicon oxynitride in the stack by etching in hot phosphoric acid before subjecting the layer of silicon oxynitride to any temperature greater than about 400°C."

In contrast to the present invention as defined by amended independent claim 1, Lee does not teach, disclose, or suggest “pattern etching the anti-reflective coating, the layer of polycrystalline silicon and the silicon nitride layer to form a stack,” and “removing the remaining layer of silicon oxynitride in the stack by etching in hot phosphoric acid before subjecting the layer of silicon oxynitride to any temperature greater than about 400°C.” Lee specifically discloses the formation of stack ST2, which includes floating gate electrode polysilicon layer FG2, inter-polysilicon layer IP2, and polysilicon control gate electrode layer CG2. See, for example, Lee, column 6, lines 19-24. However, Lee fails to teach, disclose, or suggest “pattern etching the anti-reflective coating, the layer of polycrystalline silicon and the silicon nitride layer to form a stack,” and “removing the remaining layer of silicon oxynitride in the stack by etching in hot phosphoric acid before subjecting the layer of silicon oxynitride to any temperature greater than about 400°C.”

For the foregoing reasons, Applicant respectfully submits that the present invention, as defined by amended independent claim 1, is not suggested, disclosed, or taught by Adkisson, Wolf, and Lee. As such, the present invention, as defined by amended independent claim 1, is patentably distinguishable over Adkisson, Wolf, and Lee, either singly or in any combination thereof. Thus claims 6 and 7 depending from amended independent claim 1 are, *a fortiori*, also patentably distinguishable over Adkisson, Wolf, and Lee for at least the reasons presented above and also for additional limitations contained in each dependent claim.

The present invention, as defined by amended independent claim 18, teaches, among other things, “pattern etching the layer of silicon oxynitride, the second polycrystalline silicon layer, the interpoly dielectric, the first polycrystalline silicon layer, and the gate oxide to form a stack,” and “removing the layer of silicon oxynitride in the stack without subjecting the layer of silicon oxynitride to a temperature greater than about 400°C after the step of depositing the layer of silicon oxynitride.” The present invention as defined by amended independent claim 18 achieves similar advantages as the present invention as defined by amended independent claim 10 discussed above. For similar reasons as discussed above, Adkisson, Wolf, and Lee, singly or in any combination thereof, fail to teach, disclose, or suggest “pattern etching the layer of silicon oxynitride, the second polycrystalline silicon layer, the interpoly dielectric, the first polycrystalline silicon layer, and the gate oxide to form a stack,” and “removing the layer of silicon oxynitride in the stack without subjecting the layer of silicon oxynitride to a temperature greater than about 400°C after the step of depositing the layer of silicon oxynitride.”

For the foregoing reasons, Applicant respectfully submits that the present invention, as defined by amended independent claim 18, is not suggested, disclosed, or taught by Adkisson, Wolf, and Lee. As such, the present invention, as defined by amended independent claim 18, is patentably distinguishable over Adkisson, Wolf, and Lee, either singly or in any combination thereof. Thus claims 20 and 23 depending from amended independent claim 18 are, *a fortiori*, also patentably distinguishable over

Adkisson, Wolf, and Lee for at least the reasons presented above and also for additional limitations contained in each dependent claim.

The Examiner has further rejected claims 8, 9, 15-17, 21-22, and 29-30 under 35 USC §103(a) as being unpatentable over Adkisson, Adkisson/Wolf, or Adkisson/Lee as applied to claims 1, 14, 20, and 28, and further in view of U.S. patent number 5,968,324 to Cheung et al. As discussed above, amended independent claim 1 is patentably distinguishable over Adkisson, Wolf, and Lee, amended independent claim 14 is patentably distinguishable over Adkisson and Wolf, amended independent claim 18 is patentably distinguishable over Adkisson, Wolf, and Lee, and amended independent claim 26 is patentably distinguishable over Adkisson and Wolf. As such, claims 8 and 9 depending from amended independent claim 1 and claim 21-22 depending from amended independent claim 18 are, *a fortiori*, also patentably distinguishable over Adkisson, Wolf, and Lee for at least the reasons presented above and also for additional limitations contained in each dependent claim. Also, claims 15-17 depending from amended independent claim 14 and claims 29-30 depending from amended independent claim 26 are, *a fortiori*, also patentably distinguishable over Adkisson and Wolf for at least the reasons presented above and also for additional limitations contained in each dependent claim.

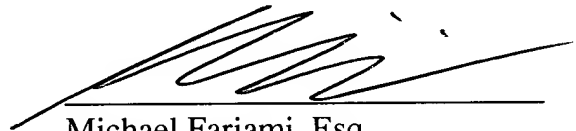
The Examiner has further rejected claims 24 and 31 under 35 USC §103(a) as being unpatentable over Adkisson/Wolf or Adkisson/Wolf/Lee as applied to claims 18 and 26, and further in view of U.S. patent number 6,245,682 to Fu et al. As discussed

above, amended independent claim 18 is patentably distinguishable over Adkisson, Wolf, and Lee and amended independent claim 26 is patentably distinguishable over Adkisson and Wolf. As such, claim 24 depending from amended independent claim 18 is, *a fortiori*, also patentably distinguishable over Adkisson, Wolf, and Lee and claim 31 depending from amended independent claim 26 is, *a fortiori*, also patentably distinguishable over Adkisson and Wolf for at least the reasons presented above and also for additional limitations contained in each dependent claim.

Based on the foregoing reasons, the present invention, as defined by amended independent claims 1, 10, 14, 18, and 26 and claims depending therefrom, is patentably distinguishable over the art cited by the Examiner. Thus, claims 1-10, 14-18, 20-24, 26, and 28-31 are also patentably distinguishable over the art cited by the Examiner. For all the foregoing reasons, an early allowance of outstanding claims 1-10, 14-18, 20-24, 26, and 28-31 and an early Notice of Allowance for all claims 1-10, 14-18, 20-24, 26, 28-31, and 33-36 pending in the present application is respectfully requested.

Respectfully Submitted,
FARJAMI & FARJAMI LLP

Date: 10/3/03

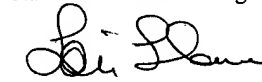

Michael Farjami, Esq.
Reg. No. 38, 135

Michael Farjami, Esq.
FARJAMI & FARJAMI LLP
16148 Sand Canyon
Irvine, California 92618
Telephone: (949) 784-4600
Facsimile: (949) 784-4601

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